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# THE DESCRIPTION OF A Pocket MICROSCOPE,

WITH

The APPARATUS thereunto belonging;

As made by

## *JOHN CUFF*,

*At the Sign of the* Reflecting Microſcope, *exactly againſt* Serjeant's-Inn Gate *in* Fleet-Street, LONDON.

AB. AB. REpreſents the Body of the *Microſcope*, made either of Silver, Braſs, or Ivory.

CC. A long fine threaded male Screw, that turns into the Body of the *Microſcope*.

D. A Convex Glaſs at the End of the ſaid Screw.

* Two Concave Pieces of thin Braſs, with Holes of different Diameters in the middle of them, to cover the ſaid Glaſs, and thereby diminiſh the Aperture, when the greateſt Magnifiers are uſed.

EE. Three thin Plates of Braſs within the Body of the *Microſcope*, one whereof is bent Semi-circularly in the Middle, ſo as to form an arched Cavity, for the Reception of a Tube of Glaſs.

F. A piece of Wood or Ivory arch'd in the Manner of the ſaid Plate, and faſtened thereto.

G. The other End of the *Microſcope*, where a hollow female Screw is adapted to receive the different Magnifiers.

H. A ſpiral Spring of Steel or Braſs between the ſaid End G and the Plates of Braſs, intended to keep the Plates in a due Poſition, and counteract againſt the long Screw CC.

I. A ſmall turned Handle for the better holding of the Inſtrument, to ſcrew on or off at Pleaſure.

To this *Microſcope* belong ſeven different magnifying Glaſſes: ſix of which are ſet either in Silver, Braſs, or Ivory, as in the Figure K, and are marked 1, 2, 3, 4, 5, 6. Obſerve, the loweſt Numbers are the greateſt Magnifiers.

L. Is the ſeventh *Magnifier*, ſet in the Manner of a little Barrel, to be held in the Hand, for the viewing any larger Object.

M. Is a flat Slip of Ivory, call'd a *Slider*, with four round Holes through it, wherein to place Objects between two Glaſſes or Talks.

Eight ſuch Ivory Sliders, and one of Braſs, uſually go along with this *Microſcope*; but whoſoever pleaſes to make a large Collection of Objects may have as many as he deſires.

The Ivory Sliders ſold herewith are number'd 1, 2, 3, 4, 5, 6, 7, 8, and contain the Objects following. Begin with the Hole in each Slider next the +

N° 1. Down of a Moth's Wing.
Farina of Mallows.
Farina of the Sun-flower.
Seed of Fern.
N° 2. Hair of a Mouſe.
Human Hair.
Wool of a Mole.
Down of a Thiſtle.
N° 3. Scales of a Perch.
Scales of a Soal-fiſh.

Scale of a Cod.
Human Skin.
Nº 4. Pith of a Ruſh.
A piece of Cork.
A piece of Spunge.
A piece of the Pith of Elder.
Nº 5. The Eye of a Fly.
The Wing of a Fly.
Pieces of a Feather.
A piece of the Wing of a Butterfly.
Nº 6. Poppy Seed.
A Louſe.
A ſmall Spider.
A ſmall Caterpillar.
Nº 7 and 8. Are Sliders without Objects, for the viewing the Animalcula in Liquids, or the Farina of Vegetables, *&c.*

The Braſs Slider is to confine any ſmall living Object, that it may be viewed, without cruſhing or [illegible]ſtroying it.

N. Is a Forceps or pair of Plyers, for the taking up of Inſects, or other Objects, and adjuſting them in the Glaſſes.

O. A little Hair Bruſh or Pencil, wherewith to put upon the Talks or Iſinglaſs any ſmall Drop of Liquid one would examine.

When you deſign to view an Object, thruſt the Ivory Slider (in which the ſaid Object is placed) between the two flat Braſs Plates EE; obſerving always to put that Side of the Slider where the Braſs Rings are, fartheſt from your Eye: Then ſcrew in the Magnifying Glaſs you intend to uſe at the End of the Inſtrument G, and looking through it againſt the Light, turn the long Screw CC, till your Object is brought to the true focal Diſtance: which you will know by its then appearing perfectly clear and diſtinct. The Way of examining any

Object accurately, is, to look at it firſt thro' a Magnifier that will ſhew the Whole thereof at once, and afterwards to inſpect the ſeveral Parts more particularly with one of the greateſt Magnifiers: for thus you will gain a true Idea of the Whole, and of all its Parts; and tho' the greateſt Magnifiers can ſhew but an exceeding minute Portion of any Object at once, ſuch as the Claw of a Flea, the Horn of a Louſe, or the like; yet by gently moving the Slider that contains your Object, the Eye will gradually behold it all; and if any Part ſhould be out of Diſtance, the Screw CC will eaſily reduce it to the true Focus.

As the Object muſt be brought very near the Glaſſes when you employ the greateſt Magnifiers, be particularly careful not to let your Slider rub againſt them as you move it in or out, leaſt you ſcratch and ſpoil your Glaſſes: This may eaſily be prevented by a few turns of the Screw CC, which will give you room enough.

You may change the Objects in your Sliders, for what others you think proper, by taking out the Braſs Rings with the Point of a Penknife: the Talks will then fall out, if you but turn the Sliders; and after putting what you pleaſe between them, by replacing the Braſs Rings you will faſten them as they were before.

The Sliders that are furniſhed with Talks, but have no Objects, are intended to be always in readineſs for the Examination of Fluids, Salts, Sand, Powders, the Farina of Flowers, or any other caſual Objects of ſuch Sort as need only be applied to the Out-ſide of the Talk.

If a little Hay, or ſome Corns of Pepper, be ſteeped in Water a few Days, in an open Veſſel, it will abound with living Creatures, ſo exceedingly minute, that, according to *Leeuwenhoek*'s Computation eight Millions two hundred and eighty thouſand Animalcula will be contained in one Drop of Water: So that on a Compariſon, was a Grain of Sand broken into eight Millions of Parts, each Part would be larger than one of theſe Inſects.

P. Is a Tube of Glaſs, contrived to confine living Objects, in order to diſcover the Blood, as it ſtreams along the Veins and Arteries.

The Circulation of the Blood may be eaſieſt ſeen in the Tails or Fins of Fiſhes, in the fine Membrane between a Frog's Toes, or (beſt of all) in the Tail of a Water-Newt. If your Object be a ſmall Fiſh, place it within the Tube, and ſpread its Tail or Fin againſt the Side thereof; if a Frog, chuſe ſuch a One as can but juſt be put into your Glaſs Tube, and with a Pen or Stick expand the tranſparent Membrane between the Toes of the Frog's hind Foot as wide as you are able. When your Object is ſo adjuſted, that no Part of it can intercept the Light from the Place you intend to view, unſcrew the long Screw CC, and thruſt your Tube into the arched Cavity, quite through the Body of the *Microſcope*; then ſcrew it to the true focal Diſtance, and you'll ſee the Blood paſſing along its Veſſels with a rapid Motion, in the Veins one way, and in the Arteries another: and in ſome of the minuteſt Branches the Globules of the Blood may be diſcerned paſſing on ſingly and ſucceſſively.

Make uſe of the 3d or 4th Magnifier for Frogs or Fiſhes; but for the Tail of Water-Newts the 5th or 6th will do, becauſe the Globules of their Blood are twice as large as thoſe of Frogs or Fiſh. The 1ſt or 2d Magnifier cannot well be employed to this Purpoſe; for the thickneſs of the Tube wherein the Object lies, will ſcarce admit its being brought ſo near as the focal Diſtance of the Magnifier.

The beſt Light for viewing Objects, is a clear Sky-Light, the Sun ſhining on any white Thing, or the Reflection of its Rays from a Looking-Glaſs: Candle Light is alſo good; but People not much practiſed in

*Microſcopes* find it ſomewhat difficult to hit the Candle exactly. But whatever Light you uſe, be very careful not to ſhade the Object by your Hat or Perriwig, for the beſt of Glaſſes can ſhew but little, unleſs the Object be at a juſt Diſtance, and have a ſufficient Light.

The ſingle *Microſcope* above deſcribed, may be formed into a double one, by ſcrewing to it a Tube with an Eye Glaſs at the End thereof. Alſo, by the Addition of a particular *Apparatus* contriv'd by Mr *Cuff* for that Purpoſe, it compoſes the beſt Kind of *Solar Microſcope*; that is, by applying it to a ſmall Hole cut in the Shutter of a Window, and directing the Sun Beams thro' it, the exact Form or Image of any tranſparent Object will be thrown upon a Linen Sheet, or Screen of Paper, placed oppoſite thereto, within the Room (which muſt be made quite dark) in a moſt beautiful and delightful Manner, and enlarged to a moſt amazing Size; for this Way, a Louſe may be magnified to the Length of 2, 3, 4, or 5 Feet, and all other Objects in a like Proportion.

Mr *Cuff* has likewiſe a new invented *Microſcope*, of a particular Structure, for viewing *Opake* Objects.—All former Contrivances for *Opake* Objects have been greatly deficient and unſatisfactory, by reaſon of their wanting Light; but by this Method, the Object is ſo ſtrongly illuminated, that it may be examined, with all imaginable Exactneſs, Eaſe, and Pleaſure.

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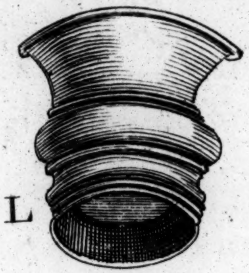

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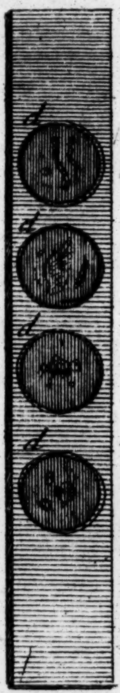

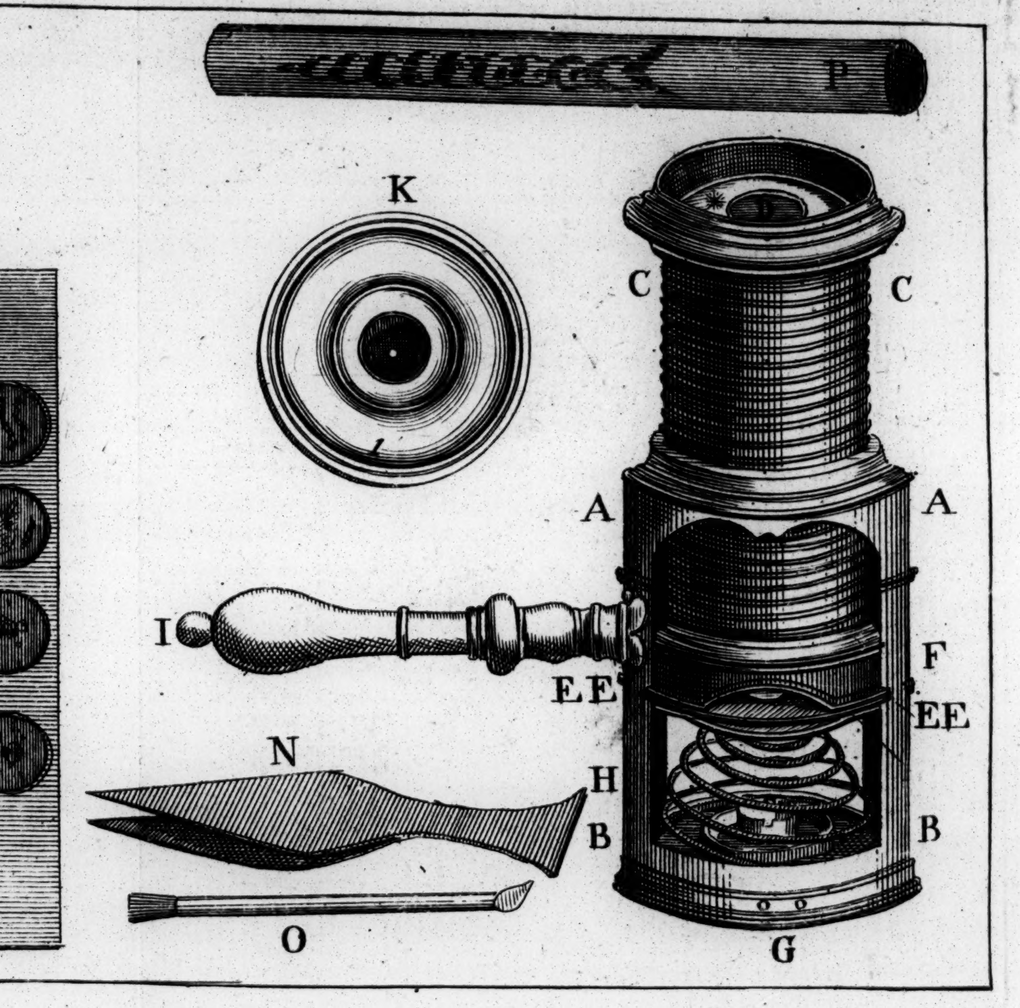
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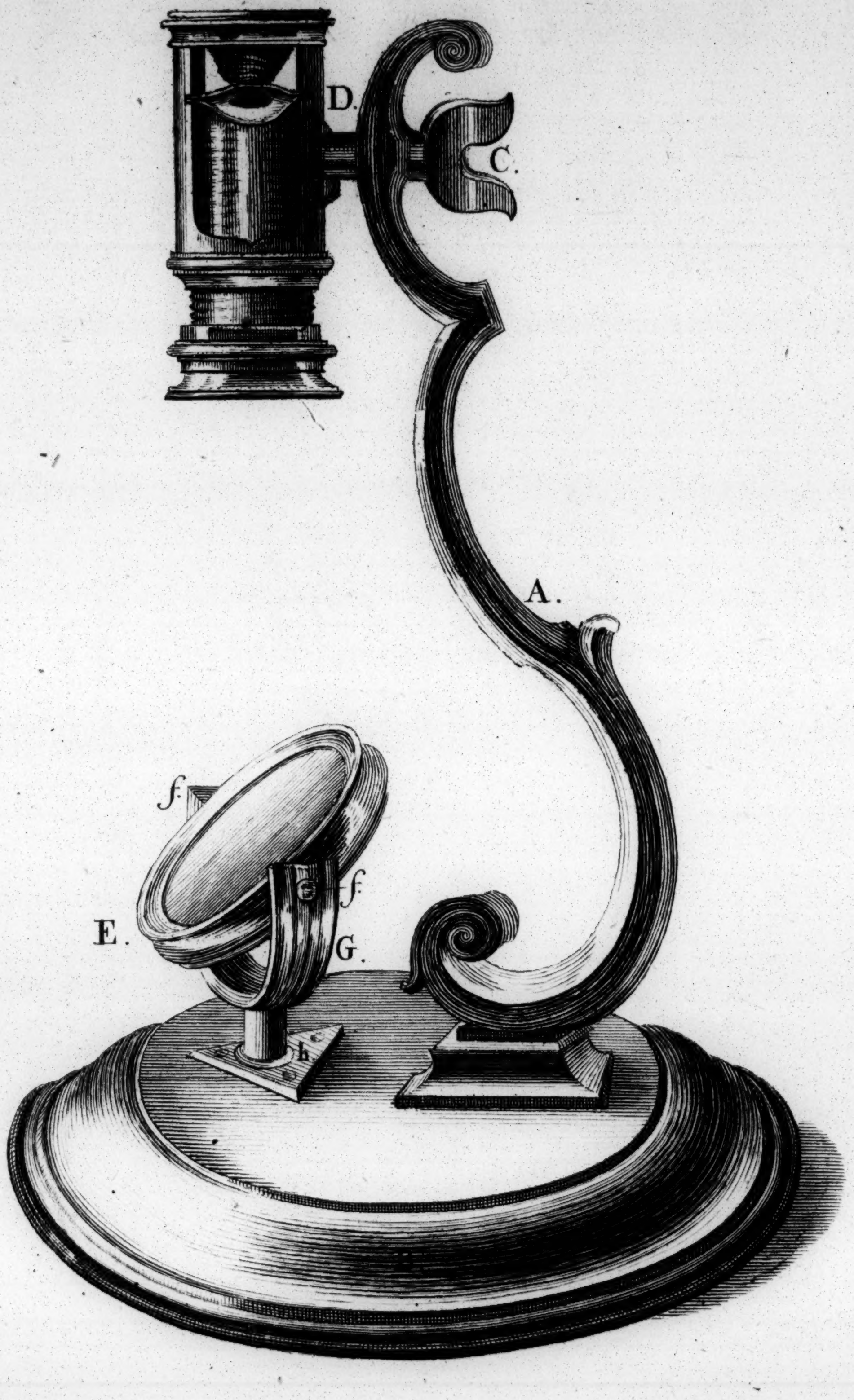

J. Tarbury del. J. Wigley Sculp.

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# THE DESCRIPTION OF A *New Invention*, To fix the Pocket MICROSCOPE,

And make it anſwer the Purpoſes of the large REFLECTING MICROSCOPE.

A. IS a Scrole of Braſs, fixt in an upright Poſition, on a round wooden Pedeſtal B, ſo as to ſtand perfectly firm and ſteady.

C. Is a braſs Screw, that paſſes thro' a Hole in the upper Limb of the Scrole into the Side of the *Microſcope* D, and ſcrews it faſt to the ſaid Scrole.

E. A Concave Looking-Glaſs or Speculum, ſet in a Box of Braſs, which hangs in the Arch G by two ſmall Screws, *ff*, that ſcrew into the oppoſite Sides thereof. At the Bottom of the ſaid Arch is a Pin of the ſame Metal, exactly fitted to a Hole *h*, in the wooden Pedeſtal made for the Reception of the ſaid Pin. As the Arch turns on this Pin, and the Speculum turns on the Ends of the Arch, it may, by this twofold Motion, be eaſily adjuſted in ſuch a Manner as to reflect the Light of the Sky, the Sun, or a Candle directly upwards thro' the *Microſcope* that is fixt perpendicularly over it, and, by ſo doing, may be made to anſwer all the Ends of the *Reflecting Microſcope*. The Body of the *Microſcope* may alſo be fixt horizontally, and Objects viewed in that Poſition by any Light you chuſe; which is an Advantage the large *Reflecting Microſcope* has not.

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# A
# DESCRIPTION
# OF THE
# *SOLAR*,
# OR,
# *Camera Obſcura* MICROSCOPE,

As Made and Sold by

***JOHN CUFF***,

At the Sign of the *Reflecting Microſcope*, directly
againſt *Serjeant's-Inn* Gate, in *Fleet-Street*,
*London*.

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WHEN the *Microſcope* is made Uſe of in the new Way, that is, by directing the Sun's Rays, thro' a Tube, upon ſome Object plac'd within and near the End of the ſaid Tube, the Image, or Picture of the Object is thrown in a moſt exact, beautiful, and ſurpriſing Manner upon a white Paper Screen, or Linen Sheet, placed on purpoſe to receive the ſame: And thus all Microſcopical Objects, that are tranſparent, may be examined with a great deal of Eaſe and Pleaſure, ſince hereby they become exceedingly magnified, beyond what they have ever been by any other Contrivance; and with theſe farther Advantages, that ſeveral People may view them at the ſame Time; that the weakeſt Eyes are in no Danger of being fatigu'd or ſtrain'd; and that even ſuch as have no Skill in Drawing, may eaſily trace out the Figure of any Object, with a Pen or Pencil, as it lies before them.

The *Apparatus* for this Purpoſe, conſiſts of a Looking-Glaſs, a Braſs Tube, a Convex Lens, and a Microſcope, (which are to be apply'd to a Hole in the Shutter of a darken'd Room, in the Manner of the *Apparatus* made Uſe of for the *Camera Obſcura*; ) and a Screen of white Paper to receive the Image or Picture of any Object to be examined.

*The Way of uſing them is as follows:*

A round Hole being made in a Window-Shutter, on which the Sun ſhines, ſufficient to receive the circular Piece of Mahogony, wherein a Braſs Tube is fixed, let the Room be made as dark as poſſible; then putting the Looking-Glaſs, and End of the Tube where the Convex Lens is placed, thro' the ſaid Hole, faſten the ſquare Frame of Wood to the Shutter by the Screws at the Corners of it, (the Bolts are to faſten the Work in the ſquare Frame;) juſt leaving Room for the Tube and Looking-Glaſs to be turn'd at Pleaſure; and by Means of a jointed Wire that paſſes from the Side of the Looking-Glaſs through the wooden Frame into the Room, you'll be able to alter the Glaſs, as the Situation of the Sun may require. When the Looking-Glaſs is placed right, it will reflect the Sun's Rays upon the Paper Screen, and form a Spot of Light exactly round; and, as ſoon as you have brought it to this, ſcrew the Tube cover'd with black to that in the Center of your wooden Frame, taking Care not to alter your Looking-Glaſs; then ſcrewing the Body of your Microſcope to the ſhort Braſs Tube of one Inch and a half (firſt taking out the Lens at the End thereof) place your Slider with the Object, as in the other Ways of uſing the Microſcope, and ſlip the ſhort Tube over the ſmall End of the Tube that projects from the wooden Frame: The Magnifiers muſt be ſcrew'd to the End of the Microſcope in the uſual Manner; and, generally ſpeaking, the 4th, 5th, or 6th Glaſs exhibits the Object beſt. You'll obſerve a ſliding Drawer in the Tube, covered with black to pull out more or leſs, as the Object is able to endure the Sun's Heat. The Focus of the Lens without ſide the Window, is at about 12 Inches, and about 11 Inches from it is commonly a proper Diſtance for Things that have no Life; but the Diſtance muſt be ſhorten'd for living Objects, 'till they can bear the Heat well. The ſhort Tube your Microſcope is ſcrew'd to, by ſliding over the other Tube eaſily, will enable you to bring your Object to the true Focal Diſtance, and to turn it round without diſplacing it.

The Way of managing the ſeveral Parts of this Microſcope, and the great Conveniency of it, will eaſily be found on Trial.

to the End of the [illegible] [illegible] [illegible] diſtinct,
and, generally ſpeaking, the 4th, 5th, or 6th Glaſs
exhibits the Object beſt. You'll obſerve a ſliding
Drawer in the Tube, covered with [illegible], to pull out
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# THE DESCRIPTION OF A MICROSCOPE FOR *Opake Objects*;

As Made and Sold by

**JOHN CUFF,**

At the Sign of the *Reflecting Microſcope* directly againſt *Serjeant's-Inn* Gate, in *Fleet-ſtreet*, *London*.

PEOPLE curious in Microſcopical Obſervations, have frequently lamented the great Difficulty of examining *Opake Objects* with any conſiderable Degree of Exactneſs or Satisfaction; for, in all the Contrivances they had met with to that Purpoſe, as the Object muſt be brought to the Focus of the Magnifier, in order to take a View thereof, the Nearneſs of the Inſtrument neceſſarily intercepted the Light from falling on it, and in ſuch a Manner overſhadowed it, as to render its Appearance obſcure and undiſtinct. And notwithſtanding Means were tried to caſt Light upon the Object, from the Sun or a Candle, by a Convex Glaſs placed on the Side thereof, the Rays from either could be thrown upon it, in ſuch an acute Angle only, as ſerved to give a confuſed Glare, but were inſufficient to afford a clear and perfect View of the Object.

But an effectual Way has been happily found out to remedy this Inconvenience; and that is, by fixing a Double-convex Lens, or Magnifier, in the Center of a Concave Speculum, whoſe Focus is near the ſame as the Focus of the ſaid Lens; whereby a ſtrong Light is reflected directly upon the Object, and every Part thereof may be examined with the utmoſt Exactneſs and Delight.

The following *Apparatus* (whoſe chief Parts are of Braſs or Silver) has been contrived for the better making uſe of the ſaid Invention.

Through the firſt Side A, paſſes a fine Screw B, the other End whereof is faſtened to the moveable Side C.

D. Is a Nut adapted to the ſaid Screw, by the turning of which the two Sides AC are gradually brought together.

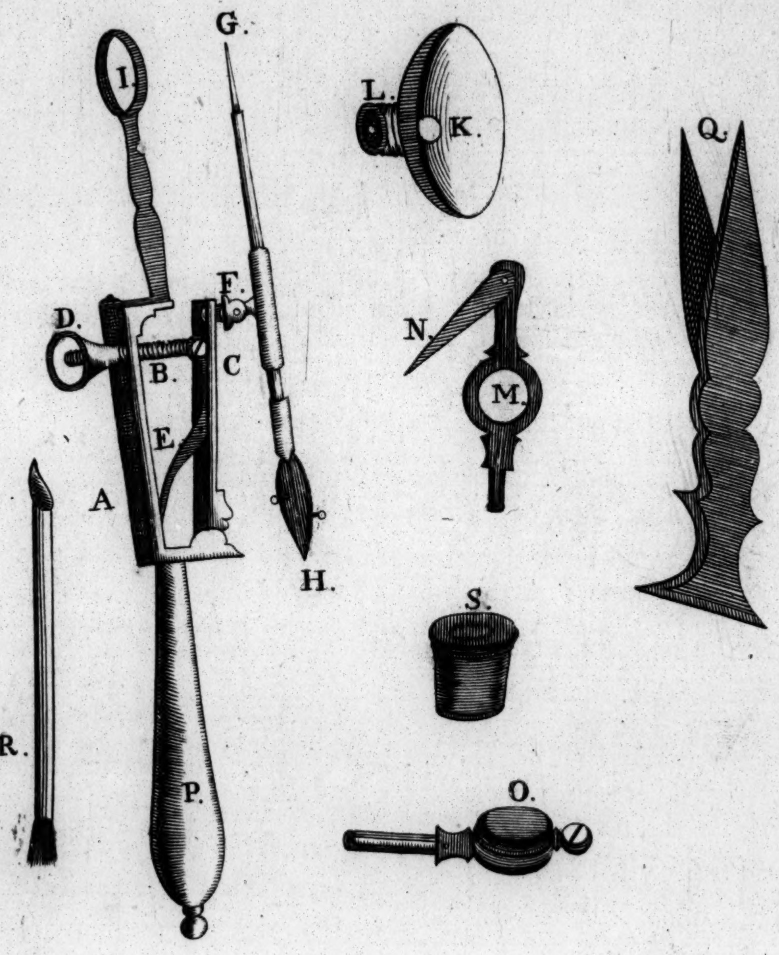
E. Is a Spring of Steel that ſeparates the ſaid two Sides, when the Nut is unſcrewed.

F. A Piece of Braſs turning round in a Socket, whence proceeds a ſmall Spring Tube moving upon a Rivet, through which Tube there runs a Steel Wire, one End whereof terminates in a ſharp Point G, and the other hath a Pair of Plyers H faſten'd to it. — The Point and Plyers are to thruſt into, or take up and hold any Inſect or Object; and either of them may be turned upwards, as may be moſt convenient.

I. A Ring of Braſs, with a Female Screw within it, mounted on an upright Piece of the ſame Metal, which turns round on a Rivet, that it may be ſet at a due Diſtance when the leaſt Magnifiers are uſed.

This Ring receives the Screws of all the Magnifiers.

K. A Concave Speculum of Silver, very highly poliſh'd, in the Center of which a Double-convex Lens is placed, with proper Apertures to look through it. On the Back of this Speculum a Male Screw L is fitted


G.
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fitted to the Braſs Ring I, to ſcrew into the ſaid Ring at Pleaſure.

There are four of theſe Concave Specula, of different Depths, adapted to four Glaſſes of different magnifying Powers, which are to be made uſe of as different Kinds of Objects may require. Obſerve, the greateſt Magnifiers are known by having the leaſt Apertures.

M. A round Object Plate, one Side white and the other black, intended to render Objects the more viſible, by placing them, if black, on the white, and if white on the black Side. A Steel Spring N turns down on each Side, to make any Object faſt, and at one End of the Object Plate is a hollow Pipe to ſcrew it on the Needle's Point G.

O. A ſmall Box of Braſs, with a Glaſs on each Side, contriv'd to confine any living Object, in order to examine it: This alſo has a Pipe to ſcrew upon the End of the Needle G.

P. A turned Handle of Wood to ſcrew into the Inſtrument when it is made Uſe of.

Q. A Pair of Braſs Plyers to take up any Object, or manage it with Conveniency.

R. A ſoft Hair Bruſh for the taking up a Drop of any Liquid, and applying it to the Iſinglaſs, to view the Animacula.

S. A ſmall Ivory Box for Talks to be placed occaſionally in the ſmall Braſs Box O.

When you would view any Object, ſcrew the Speculum with the Magnifier you intend to uſe, into the Braſs Ring I; place your Object either on the Needle G, in the Plyers H, on the Object Plate M, or in the Braſs hollow Box O, as may be moſt convenient according to the Nature of it; then holding up your Inſtrument by the Handle P, look againſt the Light thro' the magnifying Lens, and by Means of the Nut D, together with the Motion of the Needle by managing its lower End, the Object may be turned about, raiſed, or depreſſed, brought nearer the Glaſs, or put farther from it, till you hit the true focal Diſtance, and the Light be reflected from the Speculum ſtrongly upon the Object, by which Means it will be ſhewn in a Manner ſurpriſingly diſtinct and clear. And for this Purpoſe, the Light of the Sky, Sun-ſhine, or a Candle, will anſwer to your Satisfaction.

This *Microſcope* is principally intended for *Opake Objects*, but tranſparent ones may alſo eaſily be view'd by it, obſerving only, that when ſuch come under Examination, it will not always be proper to throw on them the Light reflected from the Speculum; for the Light tranſmitted through them, meeting the reflected Light, may together produce too great a Glare. A little Practice will teach how to regulate theſe two Lights to good Advantage.

There is Reaſon to expect great Diſcoveries may be made by the *Apparatus* above deſcrib'd. The famous Mr *Leewenhoek*, in all his Obſervations, uſed only ſuch ſingle Glaſſes, placed ſomewhat in the ſame Manner, but without the Advantage of our reflected Light, as is evident from his own Accounts, and alſo from twenty-ſix of them, given as a Legacy to the *Royal-Society:* And, in a Letter to the ſaid Society, he declares, his having found, in a long Courſe of Experience, "that the moſt conſiderable Diſcoveries were to be "made with ſuch Glaſſes, as, though magnifying but "moderately, exhibit the Object with the moſt perfect "Brightneſs and Diſtinction.